

WHAT IS CLAIMED IS:

1. An actuator comprising:  
magnets that are arranged in a flat form;  
5 coils that face the magnets;  
a moving member that is connected to the coils;  
a first holding member that holds the moving  
member in such a manner that the moving member can  
slide within a predetermined range; and  
10 a second holding member that holds the first  
holding member in such a manner that the first holding  
member can slide within another predetermined range in  
a direction perpendicular to the sliding direction of  
the moving member,  
15 the actuator moving the coils against the magnets.

2. An actuator comprising:  
coils that are arranged in a flat form;  
magnets that face the coils;  
20 a moving member that is connected to the magnets;  
a first holding member that holds the moving  
member in such a manner that the moving member can  
slide within a predetermined range; and  
a second holding member that holds the first  
25 holding member in such a manner that the first holding  
member can slide within another predetermined range in  
a direction perpendicular to the sliding direction of  
the moving member,  
the actuator moving the magnets against the coils.

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3. The actuator as claimed in either claim 1  
or claim 2, wherein the second holding member includes  
a pair of shafts that slidably supports the first  
holding member and are arranged at a distance from each  
35 other.

4. The actuator as claimed in claim 3, wherein

the first holding member is molded in such a manner as to be in contact only with the lower sides of the pair of shafts.

5           5.     The actuator as claimed in either claim 1 or claim 2, wherein the second holding member includes a single shaft that slidably supports the first holding member and has a quadrangular section.

10           6.     The actuator as claimed in either claim 1 or claim 2, wherein the first holding member is a molded member defined by bending pressing a plate-like material.

15           7.     The actuator as claimed in either claim 1 or claim 2, wherein:

            the moving member includes a moving piece that protrudes so that an operator can touch the moving piece; and

20           the moving piece is slidably engaged with a shaft formed in the first holding member.

            8.     An actuator comprising:  
            magnets that are arranged in a flat form;  
25           coils that face the magnets;  
            a moving member that is connected to the coils;  
            a first guide member that guides the moving member in such a manner that the moving member can slide within a predetermined range; and  
30           a second guide member that guides the first guide member in such a manner that the first guide member can slide within another predetermined range in a direction perpendicular to the sliding direction of the moving member,  
35           the actuator moving the coils against the magnets.

            9.     An actuator comprising:

coils that are arranged in a flat form;  
magnets that face the coils;  
a moving member that is connected to the magnets;  
a first guide member that guides the moving  
5 member in such a manner that the moving member can  
slide within a predetermined range; and  
a second guide member that guides the first guide  
member in such a manner that the first guide member can  
slide within another predetermined range in a direction  
10 perpendicular to the sliding direction of the moving  
member,  
the actuator moving the magnets against the coils.

10. The actuator as claimed in either claim 8  
15 or claim 9, wherein:

the moving member has a moving piece that  
protrudes so that an operator can touch the moving  
piece; and

the moving piece has engaging tongues that are to  
20 be engaged with the first guide member and prevent the  
moving piece from coming off.

11. The actuator as claimed in either claim 8  
or claim 9, wherein at least one of the first guide  
25 member and the second guide member has protrusions  
formed on a sliding surface thereof.

12. The actuator as claimed in claim 11,  
wherein the protrusions are rail-like protrusions that  
30 extend in a sliding direction.

13. The actuator as claimed in claim 11,  
wherein the protrusions are hemispheric protrusions  
that are scatteringly formed on the sliding surface.

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14. The actuator as claimed in either claim 8  
or claim 9, wherein at least one of the first guide

member and the second guide member has concavities on a sliding surface thereof.

15. The actuator as claimed in any of claims 1,  
5 2, 8 and 9, further comprising impact reducing members for reducing impact force caused when the moving member reaches an end.

16. The actuator as claimed in claim 15,  
10 wherein the impact reducing members are protrusions formed on at least one of the first holding member and the second holding member.

17. The actuator as claimed in claim 15,  
15 wherein the impact reducing members are protrusions formed on at least one of the first guide member and the second guide member.

18. The actuator as claimed in claim 15,  
20 wherein the impact reducing members are plate springs or coil springs provided on at least one of the first holding member and the second holding member.

19. The actuator as claimed in claim 15,  
25 wherein the impact reducing members are plate springs or coil springs provided on at least one of the first guide member and the second guide member.

20. The actuator as claimed in any of claims 1,  
30 2, 8 and 9, further comprising a board to which the coils are secured,

wherein the board is secured by engaging claws formed on the moving member.

21. The actuator as claimed in any of claims 1,  
35 2, 8 and 9, wherein the magnets are integrally formed with spacers by molding a magnetic material.

22. The actuator as claimed in any of claims 1, 2, 8 and 9, further comprising a resin board to which the coils are secured,

5 wherein the coils are insert-molded with the resin board and thus secured to the resin board.

23. The actuator as claimed in any of claims 1, 2, 8 and 9, further comprising a board that is  
10 integrally molded with the moving member.

24. The actuator as claimed in any of claims 1, 2, 8 and 9, further comprising a resin board to which the coils are secured,  
15 wherein the resin board has ribs for positioning and securing the coils.

25. The actuator as claimed in any of claims 1, 2, 8 and 9, wherein:  
20 the moving member has a moving piece that protrudes so that an operator can touch the moving piece; and

the actuator further comprises a stand-by mechanism that moves the moving piece to a stand-by  
25 position when the moving piece is not used.

26. The actuator as claimed in claim 25, wherein the stand-by mechanism includes a stick-like member that presses and holds the moving piece to the  
30 stand-by position.

27. The actuator as claimed in any of claims 1, 2, 8 and 9, wherein the coils are coated with a black coating.  
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28. The actuator as claimed in claim 1, wherein the magnets have surfaces subjected to a blackening

process.

29. The actuator as claimed in claim 28,  
wherein the blackening process includes application of  
5 an epoxy resin material that contains a black colorant.

30. The actuator as claimed in any of claims 1,  
2, 8 and 9, further comprising magnetoelectric  
conversion devices that detect a movement of the coils  
10 moving against the magnets.

31. The actuator as claimed in any of claims 1,  
2, 8 and 9, wherein the magnets are permanent magnets  
or electromagnets.  
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